
Fish Culture Technical Bulletin Best Management Practices

Treatment of Early Mortality Syndrome (EMS)

Early Mortality Syndrome

Early mortality syndrome (EMS) is the term now widely used to describe mortality affecting early life stages of various salmonid species in the Great Lakes. Scientists have concluded that (1) the syndrome is confined to eggs collected from wild broodstock, (2) stocks afflicted with EMS produce eggs with very low thiamine levels, and (3) mortality can be dramatically reduced by therapeutic treatments of eggs or sac fry with thiamine.

EMS is caused by a vitamin B1 (thiamine) deficiency in the adult salmonids. This thiamine deficiency can be brought on by salmonids ingesting thiaminase-containing forage fish, such as the alewife or smelt. Thiaminase is the enzyme that degrades thiamine and female salmonids pass this syndrome on to their eggs and the fry may suffer some mortality as a result.

Symptoms

Symptoms of EMS include flashing, swimming sideways, lethargic, laying on bottom of tank, and lots of wasted feed. Some portion of your fish may act this way for the first couple of weeks after they swim up. EMS can cause up to 100% mortality in hatchery raised fish. Fish will not start feeding on their own if EMS is present. This mortality typically occurs just after juvenile fish utilizing their yolk sac for food. Once the fry start feeding they will get all the thiamine they need from their feed.

Treatment

There are two stages where a thiamine treatment bath can be effective in treating EMS;

- 1) At the water hardening stage – eggs can be treated during the water hardening stage, after fertilization, and before their micropyle closes.
- 2) Sac fry to Swim-up – fish can be treated effectively from sac fry until shortly after their yolk sac is absorbed. Once fish start feeding on their own there is little benefit obtain from thiamine treatments. **It's recommended to treat fish when they have absorbed 90-95% of their yolk sac.**

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Therapeutic treatments of a 1200ppm thiamine bath for one hour can dramatically reduce EMS in **Chinook and Coho Salmon** if administered appropriately.

Thiamine Static Bath Treatment

Note: this should be done on a small test batch of fish prior to treating your whole lot of fish that are showing symptoms of EMS.

Equipment Needed:

- Aquarium air pump and air stones
- Garbage can/large bucket
- pH tester
- Baking soda
- Thiamine HCL
- Oxygen and diffusers
- Dissolved oxygen meter
- Weigh scale

Instructions:

1. Determine the volume (L) of water that will be used in the static bath treatment.

Example:

For a tank/trough that is 4m long by 50cm wide and with a water depth of 15 cm the volume of water would be:

$$\begin{aligned}\text{Volume (L)} &= \text{length (m)} \times \text{width (m)} \times \text{depth (m)} \times 1000 \text{ (conversion from m}^3 \text{ to liters)} \\ &= 4 \times 0.5 \times 0.15 \times 1000 \\ &= 300 \text{ L}\end{aligned}$$

2. Fill your tank/trough up to $\frac{3}{4}$ of the volume determine in Step1.
3. Calculate the weight (g) of Thiamine to produce a 1200ppm solution.

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Example:

Thiamine (g) = 1200ppm x Volume of water (L) / 1000 (conversion from mg to g)

Amount of Thiamine to create a 1200 ppm solution in a 100L tank would be:

$$\begin{aligned}\text{Thiamine (g)} &= (1200 \times 100) / 1000 \\ &= 120 \text{ g}\end{aligned}$$

4. Weigh out your calculated amount of Thiamine (grams) from Step 3 and mix thiamine with fresh water in bucket/garbage can and stir until all dissolved.
5. Measure the pH and buffer the solution to match your natural hatchery water's pH with Baking Soda.

Note: The solution must be buffered to match your hatchery water's pH to reduce the amount of stress imposed on the fish during treatment.

To buffer your Thiamine solution, start by adding the same amount (grams) of baking soda to your solution, as Thiamine.

- Mix well for a few minutes
- Measure the pH
- Continue to add 50g of Baking Soda until pH of the Thiamine solution and your hatchery water are equal.

(This may take some time to determine the correct amount of baking soda needed to neutralize the Thiamine solution to match the pH of your hatchery water.)

6. Aerate the solution for one hour using the aquarium air pump and air stones. This will help release any carbon dioxide produced from the baking soda.
7. Add oxygen stones to your treatment tank and turn on oxygen. Monitor the dissolved oxygen throughout the treatment procedure. Readings should be taken every 10 minutes and maintained between 70% - 90% saturation.
8. Check pH of Thiamine solution to ensure it matches your hatchery's water. Adjust if necessary.
9. Add Thiamine solution to your treatment tank by gently pouring the solution with small pail over entire tank. Gently stir to ensure solution is well mixed.

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10. Top tank up to the determined volume in Step 1.
11. Immerse fish for 1 hour.
12. Monitor treatment and if fish look stressed turn water back on and abort treatment.
13. If treating a second batch of fish, it is recommended to start back at Step 1 and do not treat a second batch of fish in the same Thiamine solution as Thiamine degrades fairly rapidly.
14. If fish are still showing signs of EMS after 4-5 days post treatment, then treat fish again following the same instructions above.

Thiamine (Thiamine HCL) Suppliers

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